REMARKS

Claims 1-37 and 49-50 were examined and rejected. Claims 38-48 have been previously canceled. Applicants amend claims 13 and 19. Applicants assert that no new matter is added therein as amended claim 13 is supported at least by claims 1, 3, 4, 14, and 15; and paragraph 31 of the application. Also, amended claim 13 is supported at least by claims 1, and 16-18 of the application. Applicants amend claim 31 to correct typographical errors, and assert that no new matter is added therein as the amendments to claim 31 are supported at least at paragraphs 32-33 and Figures 2a and 2b of the application. Applicants respectfully request reconsideration of claims 1-37, 49 and 50, as amended, in view of at least the following remarks.

I. Claims Rejected Under 35 U.S.C. §102

The Patent Office rejects claims 1-5, 7, 14, 16-20, 27-36 and 49-50 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,437,337 to Lee et al. ("Lee"). It is axiomatic that to be anticipated, every limitation of a claim must be disclosed within a single reference.

Applicants respectfully disagree with the rejection above for at least the reason that Lee does not disclose "a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising: ... second semiconductor material coupled to the first semiconductor material, the first and second semiconductor materials being halides," as required by claim 1.

Lee describes a primary purpose of being able to provide x-ray images at low x-ray exposure levels (see Abstract and col. 3, lines 65-67) using the principles of operation of (1) amplifying the charge output of photoconducting material 300 using emission layer 400 and thin gas chamber 500; or (2) amplifying the charge output by layer 2300 using gain layer 2500 (see col. 2, lines 32 – col. 4, line 56). However, Lee only describes and only enables using selenium for layer 300 or for layer 2300 as satisfying the above-noted principles of operation and primary purpose (see col. 3, lines 6-14; col. 4, lines 1-3; col. 4, lines 45-47). Specifically, for amplifying the charge output by layer 2300 using gain layer 2500, Lee only discloses that layer 2300 "carries out a function

similar to that of layer 300" (see col. 4, lines 31-32), and only describes layer 2300 as amorphous selenium (see col. 4, lines 45-47).

However, the Patent Office has not identified and Applicants are unable to find any description in Lee of a heterojunction of a first halide material coupled to a second halide material, as required by claim 1.

In addition, each teaching in Lee requires a charge multiplying gain layer, which leads to photoconductive gain (charge multiplication within the gain layer) which can be problematic because it leads to increased noise and degraded image quality. On the other hand, by including the claimed heterojunction of a second semiconductor halide material coupled to the first semiconductor halide material, embodiments described in the specification of the present application, for example, without limitation thereto, may provide one or more benefits of: (1) collecting charge and then amplifying the charge (see paragraph 39 of the application); (2) choosing a bias voltage to determine the sensitivity of the detector (see paragraph 39 of the application); and (3) using amplifiers 519 to drive analog to digital converters (see paragraph 40 of the application), thus avoiding photoconductive gain (charge multiplication) and avoiding increased noise and degraded image quality. Consequently, Lee teaches against and can not provide such benefits, as Lee requires the charge multiplying gain layer. Thus, a practitioner would not consider Lee for teaching the above noted claims; and would not consider combining Lee with another reference to teach those claims.

Similarly, Applicants respectfully disagree with the rejection above of claim 49, for at least the reason that Lee does not disclose a photodetector comprising a heterojunction formed of two semiconductor materials, being halides, wherein at least one of the first and second semiconductor materials consist essentially of a semiconductor material, as required by claim 49.

An analogous to the one above for claim 1 applies here as well.

Next, Applicants respectfully disagree with the rejection above of claim 30, for at least the reason that Lee does not disclose "means for reducing dark current in the heterojunction structure," as required by claim 30.

Lee describes embodiments as noted above for claim 1. However, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted limitations of claim 30. For example, Lee describes that a structure including electron blocking layer 200, bias electrode 100 and photoconductor 300 of amorphous Selenium may reduce the magnitude of dark current that flows in the device in the absence of x-ray illumination (see col. 3, lines 53-58). However, Lee does not describe any of the embodiments noted in the Applicant's specification for reducing dark current.

Next, Applicants respectfully disagree with the rejection above of claim 30, for at least the reason that Lee does not disclose "a contact coupled to the first semiconductor material, wherein the first semiconductor material is less corrosive than the second semiconductor material to the contact," as required by claim 31.

Lee describes the embodiments noted above for claim 1. However, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted limitations of claim 31. For example, in those embodiments, there is no description in Lee that the HgI_2 of gain layer 2500 is less corrosive than amorphous selenium to collector electrode 600 (see col. 4, lines 45-47 and Figure 3).

In addition to being dependent on allowable base claim 1, Applicants disagree with the rejection above of claim 14 for at least the reason that Lee does not disclose "wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material," as required by claim 14.

The Patent Office cites col. 2 lines 32-40 of Lee against the above limitation stating "(the charge generation layer 300 or 2300 can be Hgi2, PbI2, a-selenium, others, and combination or subcombination thereof). Applicant's disagree. First, Lee only states "Layer 300 can comprise, for example, amorphous selenium, PbI.sub.2, CdTe, CdZnTe, TIBr, HgI.sub.2, silicon, germanium, PbO.sub.2, with or without doping materials, and combinations or subcombinations thereof," but does not describe layer 300 as more than a single layer of material. Also, as noted above for claim 1, for layer 300 or 2300, Lee only describes a single layer of a-selenium as satisfying the primary

purpose and principles of operation of Lee (see col. 3, lines 6-14; col. 4, lines 1-3; col. 4, lines 45-47).

Consequently, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted 3-layer limitations of claim 14.

In addition, Applicants disagree with the rejection of amended independent claim 19 for at least the reason that claim 19 requires "wherein the second semiconductor material has a conductivity type different than the first semiconductor material; wherein the band gaps of the first and second semiconductor materials are within 10 percent of each other; wherein the first semiconductor material comprises mercuric iodide and the second semiconductor material comprises lead iodide; and wherein the second semiconductor material is thicker than the first semiconductor material." However, the cited references do not disclose or teach such limitations.

In addition to being dependent on allowable base claim 1, Applicants disagree with the rejection above of claim 28 for at least the reason that Lee does not disclose "wherein the first contact is coupled to ground and the second contact is coupled to a negative voltage," as required by claim 28.

As shown in Figures 1 and 3 of Lee, the negative bias is applied to layer 300 or 2300, while a positive voltage is applied to collector electrode 600. However, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted limitation of claim 28.

Applicants also disagree with the rejection of claim 35 for the reason that, in addition to being dependent upon allowable base claim 31, claim 35 requires that the first semiconductor material is lead iodide and the second semiconductor material is mercuric iodide. On the other hand, as noted above for claim 1, such an embodiment is not disclosed, nor is such an embodiment described as satisfying the primary purpose or principles of operation required by Lee.

For example, Lee describes making layer 2500 of a material of a <u>much lower</u> atomic number so its x-ray cross-section is lower than that of layer 2300 (see col. 5, lines 9-10). However, Lee does not disclose one of the layers being mercuric iodide (the

atomic number for mercury, Hg, is 80) and the other material being lead iodide (the atomic number for lead, Pb, is 82).

II. Claims Rejected Under 35 U.S.C. § 103

The Patent Office rejects claims 6, 8-13 and 15 under 35 U.S.C. §103(a) as being unpatentable over Lee in view of U.S. Patent No. 6,353,229 issued to Polischuk, et al. ("Polischuk"). Next, the Patent Office rejects claims 21-26 and 37 under 35 U.S.C. §103(a) as being unpatentable over Lee in view of U.S. Patent No. 6,949,750 to Tusutsui et al. ("Tusutsui").

Applicants submit that dependent claims 6, 8-13, 15, 21-26 and 37, being dependent upon an allowable base claims 1 and 31, are patentable over the cited references for at least the reasons described above in support claims 1 and 31. Hence, for at least those reasons, Applicants respectfully request the Patent Office withdraw the rejection above of claims 6, 8-13, 15, 21-26 and 37.

Moreover, Polischuk fails to cure the shortcoming of the references noted above for independent claims 1, 30, 31, and 49. Polischuk teaches that a top electrode material may be palladium, gold, aluminum, molybdenum, or platinum (see column 5 lines 54-56) but does not disclose or teach the above noted limitations of claims 1, 30, 31, and 49.

Finally, Tusutsui fails to sure the shortcomings of the other references for independent claims 1, 30, 31, and 49. Tusutsui discloses a single photo conversion layer 4 but not dual layers, or a heterojunction as required by claims 1, 30, 31, and 49.

With respect to claims 8-13 and 15, Applicants traverse that the limitations of those claims would have been obvious to one of ordinary skill in the art in light of the teachings of Lee as optimum or workable range by routine experimentation, and respectfully request that the Patent Office cite a reference in support of such a position. For example, as noted for claim 1, the principle of operation and primary purpose of Lee do not allow such thicknesses.

In addition, Applicants disagree with the rejection of dependent claim 11 for at least the reason that, in addition to being based upon allowable base claim 1, claim 11

requires "wherein the second semiconductor material is thicker than the first semiconductor material."

On the other hand, in the second case described above with respect to claim 1, Lee describes that a much thinner gain layer can be used for layer 2500 as compared to layer 2300 (see col. 4, line 62 – col. 5, line 15). Thus, Lee describes where layer 2500 is much thinner than layer 2300 (see col. 5, lines 7-10).

In addition, Applicants disagree with the rejection of amended independent claim 13 for at least the reason that claim 13 requires "wherein the second semiconductor material comprises mercuric iodide, and the first semiconductor material comprises lead iodide; wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material; wherein the first semiconductor material has a first thickness less than approximately 50 microns, the second semiconductor material has a second thickness greater than approximately 250 microns, and the third semiconductor material has a third thickness less than approximately 50 microns." However, the cited references do not disclose or teach such limitations.

Applicants submit that any dependent claims not mentioned above, being dependent upon allowable base claims, are patentable over the cited references for at least the reasons explained above as well as additional limitations of those dependent claims. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of all claims as being unpatentable over the cited references.

CONCLUSION

In view of the foregoing, it is believed that all claims now are now in condition for allowance and such action is earnestly solicited at the earliest possible date. If there are any additional fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666.

Respectfully submitted,

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CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence is being submitted electronically via EFS Web on the date shown below to the United States Patent and Trademark Office.

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